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MEMORANDUM

To: Rob Law (*de maximis, inc.*)

From: Windward Environmental LLC

Subject: LPRSA Upper 9-Mile Current Conditions Biota Sampling – Key Details

Date: June 7, 2019

This memorandum presents the key details regarding the Year 1 current conditions sampling effort planned for September/October 2019. An adaptive sampling design is proposed, in which the Year 1 data will be evaluated and used to inform any changes needed for the Year 2 sampling (to be conducted in late summer/early fall 2020). Year 1 and Year 2 data will form the current conditions dataset.

DQOs

The following three data quality objectives (DQOs) are proposed for the current conditions sampling effort:

- **DQO 1 –** Collect sufficient fish/crab biota data prior to performing the interim remedy so that appropriate comparisons (e.g., statistical, graphical, etc.) of pre- and post-interim remedy data can be made (to the extent practicable based on the successful collection of sufficient fish/crab) for each target species (i.e., American eel, blue crab, carp, sunfish, and white perch) and chemical of concern. Comparisons may include both short- and long-term monitoring data in order to determine changes in fish and crab tissue concentrations following completion of the interim remedial action. Target species of fish/crab from two sampling reaches (i.e., river mile [RM] 8.3 to RM 15 and RM 15 to Dundee Dam) will be collected to the extent practicable.[1]

[1] A reasonable effort is defined as a three-week field effort conducted by a six-person field crew (i.e., 20 trap soaks in lower reach, 20 gillnets attempts, 4 electroshocking events by boat; upper reach 5 nights of trap soaks, 2 passes with electroshocking, up to 2 beach seine attempts). See Table 3.

- **RM 8.3 to RM 15** – Based on habitat and previous Lower Passaic River Study Area (LPRSA) biota sampling, sufficient fish and crab are reasonably likely to be collected to achieve the calculated sample size goals[2] for most of the target species.
- **RM 15 to RM 17.4** – Based on habitat and previous LPRSA biota sampling, the Cooperating Parties Group (CPG) and US Environmental Protection Agency (USEPA) acknowledge that it is unlikely that sufficient fish and crab will be collected to achieve the calculated sample size goals in this area. Appropriate habitat for most target species above approximately RM 15 to RM 16 is limited (i.e., area is shallower, with higher flow rates and coarser bottom), and the overall length of this sampling area is relatively short (i.e., approximately 2.4 river miles as compared with approximately 6.7 river miles from RM 8.3 to RM 15). As such, a reasonable effort, one that considers the length of the reach, limited access, and less suitable habitat above approximately RM 15 to RM 16, will be made to collect biota in this area. If available fish and crab samples are insufficient[3] for a minimum number of composite samples (n = 5), DQO 1 would be considered unachievable and will not be exercised.

- **DQO 2** – Evaluate bioaccumulation model performance using the current condition fish and crab tissue data and refine model as needed post-Record of Decision (ROD).[4]
- **DQO 3** – Identify and refine specific characteristics (e.g., abundance, size, age, range, etc.) to support development of both short-term (i.e., current condition sampling program) and long-term (e.g., post-interim remedy) sampling programs. Adjustments to sample sizes will be made, if warranted, following each current condition sampling event.

DQO 3 was added to address discussions during the May 28, 2019, teleconference.

TARGET SPECIES, SIZES, AND COMPOSITING DETAILS

As previously discussed, five species (i.e., American eel, blue crab, carp, sunfish, and white perch) were identified as target species for DQOs 1 and 3 based on the 2009/2010 sampling effort (Table 1). In addition, to support DQO 2, bass and catfish will be retained but not subject to sample size goals established for the designated target

[2] Target numbers of composites were calculated using the 2009/2010 LPRSA dataset and based on the ability to detect a 50% reduction in average tissue concentrations assuming 80% power and 95% confidence using a non-parametric evaluation.

[3] After a reasonable effort as described in Table 3

[4] The evaluation of the bioaccumulation model performance will require updated Contaminant Fate and Transport (CFT) model results.

species. Compositing will be determined following the completion of sampling in coordination with USEPA using the following criteria:

- **Catch location** – To the extent possible, composites will group fish/crab from nearby locations (preferably within the same river mile). Special attention will be given to the RM 15 boundary (i.e., no fish/crab will be composited across the RM 15 boundary).
- **Size of individuals** – When possible, all individuals included in a given composite will be of similar size, so that the smallest individual in a composite is no less than 75% of the length of the largest individual (USEPA 2000). However, this target size requirement will be evaluated in conjunction with USEPA to determine whether this criterion can be realistically applied to those species less represented during sampling.

To establish the target sample sizes presented in Table 1, a non-parametric power analysis was conducted using R software; key assumptions were 80% power, 95% confidence, and an expected reduction in mean tissue concentrations (post-remedy) of 50%. The 2009/2010 fish tissue dataset for total PCB congener and 2,3,7,8-TCDD was used to inform the analysis, which relied on a Monte Carlo simulation approach combined with the Mann-Whitney U test. A total of 2,000 simulations were conducted, and the fraction of Mann-Whitney U test results that were significant (i.e., one-tailed test, $p < 0.05$ was evaluated). This fraction is equivalent to the statistical power. This process was conducted for fish tissue samples across the entire 9-mile sampling area and for those samples collected upstream of RM 15.[5] This evaluation results in the selection of Year 1 targets of 12 and 5 composites per year in each area (RM 8.3 to RM 15 and RM 15 to Dundee Dam, respectively) that should provide the desired power and confidence over two years. The data collected in 2019, will be reevaluated using a similar power analysis and determine whether the target sample numbers for 2020 sampling should change.

[5] Samples from the 2009/2010 dataset showed a substantial decrease in concentrations upstream of approximately RM 13. To increase the sample size when parameterizing the Monte Carlo for the above RM 15 evaluation, samples from above RM 13 were included. It is expected that fish tissue collected upstream of RM 15 will be more similar to data collected upstream of RM 13 than downstream of that area.

Table 1. Summary of target species, tissue types, and sizes proposed for collection during current conditions biota sampling in 2019

Species Group[a]	Tissue Type(s)	Individuals per Composite	Target No. of Composites (per Tissue Type)		Size Range (mm)	
			RM 8.3–RM 15	RM 15–Dundee Dam	Target	Retain
Target species						
American eel	fillet, carcass	3	12[c]	5[bc]	400–600	350–700
Blue crab	edible meat + hepatopancreas, carcass	3	12	5[b]	125–145	115–155
Carp	fillet, carcass	3	12	5[b]	500–600	500–600
Sunfish (bluegill, pumpkinseed, etc.)	whole body	5	12[c]	5[b]	100–140	80–160
White perch	fillet, carcass	3	12	5[b]	150–200	125–225
Additional species						
Bass (largemouth and smallmouth bass)	whole body	3	up to 3 composites depending on catch		200–300	> 150
Catfish (channel catfish, white catfish)	whole body	3	up to 3 composites depending on catch		400–500	300–600

Note: Target size ranges of fish to retain during sampling were developed based on review of the 2009/2010 fish collection dataset and the analytical mass needed for the targeted analyte list (see Table 3).

[a] The target species (i.e., American eel, blue crab, sunfish, carp, and white perch) are proposed for collection for USEPA's DQO 1 and DQO 2 (i.e., bioaccumulation model refinement); additional species (i.e., catfish and bass) are proposed for collection as part of DQO 2 only.

[b] As described in DQO 1 for RM 15 to Dundee Dam, it is unlikely that sufficient individuals of most fish and crab species will be collected to achieve the targeted 5 composites per species in this area (see Table 2 for a summary of the 2009/2010 catch results). The number of composites will be determined based on catch results during sampling.

[c] Based on the 2009/2010 catch results, it is uncertain whether sufficient individuals will be collected to create the targeted number of composites (see Table 2).

DQO – data quality objective
RM – river mile
USEPA – US Environmental Protection Agency
TBD – to be determined

Although it is possible that catch results will be different during current conditions sampling work, the catch results for the 2009/2010 tissue sampling and community survey work were evaluated to help inform the achievability of the proposed sampling effort. Table 2 presents the target species proposed for analysis, the number of individuals to be collected in each river mile (and the total in each of the proposed sampling areas), and whether the 2009/2010 catch would have been sufficient to achieve the targeted number of composites presented in Table 1 (i.e., 12 per area for the target species); the additional species (bass and catfish) are not subject to sample size goals.

Table 2. Counts by river mile and sampling area using 2009/2010 LPRSA data

Species	Sizes Included in Counts	Count of Individuals by River Mile										Count by Area		Achieve Target Based on 2009/2010 Data?	
		RM 8–RM 9	RM 9–RM 10	RM 10–RM 11	RM 11–RM 12	RM 12–RM 13	RM 13–RM 14	RM 14–RM 15	RM 15–RM 16	RM 16–RM 17	RM 17–Dam	RM 8–RM 15	RM 15–Dundee Dam	RM 8.3–RM 15 (n = 12)	RM 15–Dundee Dam (n = 5)
Target species															
American eel	excluded small eel (< 350 mm)	8	10	0	4	1	1	1	0	1	1	25	2	no	no
Blue crab	excluded if smaller than minimum legal size (< 115 mm)	10	12	37	5	8	37	29	13	9	3	138	25	yes	yes
Carp	excluded if outside range of 450–600 mm	10	11	23	24	19	32	15	11	4	1	134	16	yes	yes
Sunfish	excluded small fish (< 80 mm)	6	7	4	3	3	5	2	17	21	21	30	59	no	yes
White perch	excluded small fish (< 125 mm)	29	29	8	5	4	9	1	27	1	1	85	29	yes	yes
Additional species															
Bass	excluded small fish (< 150mm)	0	5	0	3	0	0	0	3	6	1	8	10	na	na
Catfish	excluded small fish (< 250 mm)	2	1	6	6	2	2	7	4	0	0	26	4	na	na

LPRSA – Lower Passaic River Study Area

RM – river mile

na – not applicable

LEVEL OF EFFORT AND PLANNING SAMPLING SCHEDULE

As discussed with USEPA during the May 28, 2019, conference call, the 2019 current conditions sampling will be planned as a three-week effort (total of 18 field days) by a six-person field crew (likely operating as two teams of three people). Based on field crew knowledge of the site from past sampling efforts, the area from RM 8.3 to approximately RM 16 is accessible by boat; areas above this boundary were previously sampled from land where limited access to the LPRSA shoreline was possible. Thus, the three-week sampling event will be organized as follows:

- **Week 1** – Sampling by boat from RM 8.3 to RM 12 (6 field days)
- **Week 2** – Sampling by boat from RM 12 to approximately RM 16 (or farthest upstream area accessible by boat) (6 field days)
- **Week 3** – Sampling by land from approximately RM 16 to Dundee Dam (where access is possible) and additional sampling by boat to fill in gaps for RM 8.3 to RM 16 (6 field days)

This proposed level of effort is consistent with past biota tissue sampling in the LPRSA, during which the field crew covered 4 river miles per week. Table 3 presents the proposed level of effort for each sampling area.

Table 3. Level of effort

Sampling Method	RM 8.3 to RM 12	RM 12 to RM 16	RM16 to Dundee Dam
Trap/trotline sets — total number of overnight soaks per set[a]	4 sets for 5 overnight soaks	4 sets for 5 overnight soaks	1 set of traps for 5 overnight night soaks (habitat not likely appropriate for trotlines)
Gillnets — total number of overnight soaks per gillnet	4 sets for 5 overnight soaks	4 sets for 5 overnight soaks	NA (habitat not appropriate for gillnets)
Electrofishing	Minimum of 2 passes (maximum 4 passes) at each appropriate location (by boat from RM 8.3 to RM 16; backpack above RM 16). Locations will depend on habitat suitability and site access.		
Beach seining	Minimum of 1 attempt (maximum 3 attempts) at each appropriate location. Locations will depend of habitat suitability, and presence of shallow wadeable waters where safe to seine.		

[a] Each gear set consists of three individual traps or trotlines.

ANALYTES AND FISH AGING

Table 4 presents the proposed analytes, the prioritization of those analytes (if situations arise in which insufficient mass is available from a given composite), and the laboratories/methods that will be used. For fish with scales (i.e., carp, sunfish, white perch, and bass), scales will be removed during field processing and submitted for age determination to support DQO 2.

Table 4. Target analytes (in order of priority), laboratory, and analytical method

No.	Analyte	Laboratory	Method	Minimum Mass (g)[a]	Notes Regarding Lab/Method Change from Past LPRSA Sampling?
1	PCDDs/ PCDFs	Cape Fear Analytical	USEPA 1613B	10-30	Lab was changed from Analytical Perspectives to Cape Fear Analytical due to staffing turnover and change in management.
2	PCB congeners	Cape Fear Analytical	USEPA 1668C	10	
3	Lipids	Alpha Analytical	NOAA Technical Memorandum NOS ORCA 130	5	Method was updated to avoid hazardous chemical exposure; lab was changed from ALS-Kelso to Alpha Analytical to reduce number of labs and sample split/shipping costs.
4	Percent moisture	Alpha Analytical	SM 2540G	5	no change
5	Total mercury and methylmercury	Brooks Applied Labs	USEPA 1631/ USEPA 1630	10	no change
6	Copper and lead	Alpha Analytical	USEPA SW846 6020	10	Lab was changed from ALS-Kelso to Alpha Analytical to reduce number of labs and sample split/shipping costs.
7	Select pesticides (total DDX and dieldrin)	Vista Analytical Laboratories	USEPA 1699 Mod.	10-20	No change
8	PAHs	Vista Analytical Laboratories	CARB 429 Mod.	10-20	

[a] Mass requirements are tentative, pending finalization with laboratories. Additional mass will be needed for QA/QC samples and USEPA split samples (if desired). Overall mass requirements are TBD.

CARB – California Air Resources Board
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
LPRSA – Lower Passaic River Study Area
NOAA – National Oceanic and Atmospheric Administration
NOS – National Ocean Service
ORCA – Ocean Resources Conservation and Assessment
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCDD – polychlorinated dibenzo-*p*-dioxin
PCDF – polychlorinated dibenzofuran
QA/QC – quality assurance/quality control
SM – Standard Method
TBD – to be determined
total DDx – sum of all six DDT isomers (2,4′-DDD, 4,4′-DDD, 2,4′-DDE, 4,4′-DDE, 2,4′-DDT and 4,4′-DDT)
USEPA – US Environmental Protection Agency